CLAIMS

What is claimed is:

1   1.   An integrated voice activation detector for

2   detecting whether voice is present, the integrated voice

3   activation detector comprising:

4   a semiconductor integrated circuit including,

5   at least one signal processing unit to perform

6   voice detection; and

7   a processor readable storage means to store

8   signal processing instructions for execution by the

9   at least one signal processing unit to:

10   detect whether noise is present to

11   determine whether a noise flag should be set;

12   detect a predetermined number of zero

13   crossings to determine whether a zero crossing

14   flag should be set;

15   detect whether a threshold amount of

16   energy is present to determine whether an

17   energy flag should be set;

18   detect whether instantaneous energy is

19   present to determine whether a instantaneous

20   energy flag should be set; and

21   utilize a combination of the noise,

22   zero crossing, energy, and instantaneous energy

23   flags to determine whether voice is present.

1   2.   The integrated voice activation detector of

2   claim 1, wherein the signal processing instructions

3   further for execution by the at least one signal

4   processing unit to, perform fast Fourier transformation

5   (FFT) processing to determine whether a FFT flag should

6   be set.

1   3. The integrated voice activation detector of

2   claim 1, wherein the signal processing instructions

3   further for execution by the at least one signal

4   processing unit to, perform an interim voice activity

5   decision, a interim voice activity decision flag being

6   set to indicate voice has been detected by determining if

7   the instantaneous energy flag is set or the energy flag

8   is set and the noise flag is not set and the zero

9   crossing flag is not set.

1   4.   The integrated voice activation detector of

2   claim 3, wherein the signal processing instructions

3   further for execution by the at least one signal

4   processing unit to, perform HangOver and Speech Kick in

5   processing after the interim voice activity decision has

6   been made to determine whether a voice activity flag

7   should be set or cleared.

1   5.   The integrated voice activation detector of

2   claim 4, wherein the signal processing instructions

3   further for execution by the at least one signal

4   processing unit to, if the voice activity flag is set,

5   send a speech payload to be packetized and update the

6   voice activity detection flag for external interaction

7   with other functions of the semiconductor integrated

8   circuit.

1   6.   The integrated voice activation detector of

2   claim 4, wherein the signal processing instructions

3   further for execution by the at least one signal

4   processing unit to, if the voice activity flag is not

5 set, disable an automatic level control and cause a

6 silence insertion description payload to be prepared.

1   7. The integrated voice activation detector of

2 claim 1, wherein detecting a predetermined number of zero

3 crossings to determine whether a zero crossing flag

4 should be set includes determining whether a root mean

5 square crossing value is greater than a threshold value.

1   8. The integrated voice activation detector of

2 claim 1, wherein detecting whether noise is present to

3 determine whether a noise flag should be set includes

4 determining whether energy in a current frame multiplied

5 by a threshold is greater than delayed frame energy.

1   9. The integrated voice activation detector of

2 claim 1, wherein detecting whether a threshold amount of

3 energy is present to determine whether an energy flag

4 should be set includes determining if a logarithm of an

5 autocorrelation of a frame is greater than an energy

6 threshold.

1   10. The integrated voice activation detector of

2 claim 1, wherein detecting whether instantaneous energy

3 is present to determine whether an instantaneous energy

4 flag should be set includes determining whether a

5 difference between a current frames energy at an

6 autocorrelation of a tenth delayed sample and a prior

7 frames energy at an autocorrelation of a tenth delayed

8 sample is greater than a previous frames autocorrelation

9 multiplied by a threshold.

1   11. A method for voice activation detection to

2 detect whether voice is present, the method comprising:

3   detecting whether noise is present to

4   determine whether a noise flag should be set;

5   detecting a predetermined number of

6   zero crossings to determine whether a zero

7   crossing flag should be set;

8   detecting whether a threshold amount of

9   energy is present to determine whether an

10   energy flag should be set;

11   detecting whether instantaneous energy

12   is present to determine whether a instantaneous

13   energy flag should be set; and

14   utilizing a combination of the noise,

15   zero crossing, energy, and instantaneous energy

16   flags to determine whether voice is present.

1   12. The method of claim 11, further comprising,

2   performing fast Fourier transformation (FFT) processing

3   to determine whether a FFT flag should be set.

1   13. The method of claim 11, further comprising,

2   performing an interim voice activity decision, a interim

3   voice activity decision flag being set to indicate that

4   voice has been detected by determining if the

5   instantaneous energy flag is set or the energy flag is

6   set and the noise flag is not set and the zero crossing

7   flag is not set.

1   14. The method of claim 13, further comprising,

2   performing HangOver and Speech Kick in processing after

3   the interim voice activity decision has been made to

4   determine whether a voice activity flag should be set or

5   cleared.

1   15. The method of claim 14, further comprising, if

2   the voice activity flag is set, sending a speech payload

3   to be packetized and updating the voice activity

4   detection flag for external interaction with other

5   functions.

1   16. The method of claim 14, further comprising, if

2   the voice activity flag is not set, disabling an

3   automatic level control and causing a silence insertion

4   description payload to be prepared.

1   17. The method of claim 11, wherein detecting a

2   predetermined number of zero crossings to determine

3   whether a zero crossing flag should be set includes

4   determining whether a root mean square crossing value is

5   greater than a threshold value.

1   18. The method of claim 11, wherein detecting

2   whether noise is present to determine whether a noise

3   flag should be set includes determining whether energy in

4   a current frame multiplied by a threshold is greater than

5   delayed frame energy.

1   19. The method of claim 11, wherein detecting

2   whether a threshold amount of energy is present to

3   determine whether an energy flag should be set includes

4   determining if a logarithm of an autocorrelation of a

5   frame is greater than an energy threshold.

1   20. The method of claim 11, wherein detecting

2   whether instantaneous energy is present to determine

3   whether an instantaneous energy flag should be set

4   includes determining whether a difference between a

5   current frames energy at an autocorrelation of a tenth

6   delayed sample and a prior frames energy at an

7   autocorrelation of a tenth delayed sample is greater than

8   a previous frames autocorrelation multiplied by a

9   threshold.

1   21. An apparatus comprising:

2   at least one signal processing unit to perform

3   voice detection; and

4   a storage device to store signal processing

5   instructions for execution by the at least one

6   signal processing unit to:

7   determine whether a noise flag, a zero

8   crossing flag, an energy flag, and an

9   instantaneous energy flag should be set; and

10   utilize a combination of the noise,

11   zero crossing, energy, and instantaneous energy

12   flags to determine whether voice is present.

1   22. The apparatus of claim 21, wherein the signal

2   processing instructions further for execution by the at

3   least one signal processing unit to:

4   detect whether noise is present to

5   determine whether the noise flag should be set;

6   detect a predetermined number of zero

7   crossings to determine whether the zero

8   crossing flag should be set;

9   detect whether a threshold amount of

10   energy is present to determine whether the

11   energy flag should be set; and

12   detect whether instantaneous energy is

13   present to determine whether the instantaneous

14   energy flag should be set.

1   23. The apparatus of claim 21, wherein the signal

2   processing instructions further for execution by the at

3   least one signal processing unit to, perform fast Fourier

4   transformation (FFT) processing to determine whether a

5   FFT flag should be set.

1   24. The apparatus of claim 21, wherein the signal

2   processing instructions further for execution by the at

3   least one signal processing unit to, perform an interim

4   voice activity decision, a interim voice activity

5   decision flag being set to indicate voice has been

6   detected by determining if the instantaneous energy flag

7   is set or the energy flag is set and the noise flag is

8   not set and the zero crossing flag is not set.

1   25. The apparatus of claim 24, wherein the signal

2   processing instructions further for execution by the at

3   least one signal processing unit to, perform HangOver and

4   Speech Kick in processing after the interim voice

5   activity decision has been made to determine whether a

6   voice activity flag should be set or cleared.

1   26. The apparatus of claim 25, wherein the signal

2   processing instructions further for execution by the at

3   least one signal processing unit to, if the voice

4   activity flag is set, send a speech payload to be

5   packetized and update the voice activity detection flag

6   for external interaction with other functions of the

7   semiconductor integrated circuit.

1   27. The apparatus of claim 25, wherein the signal

2   processing instructions further for execution by the at

3   least one signal processing unit to, if the voice

4   activity flag is not set, disable an automatic level

5   control and cause a silence insertion description payload

6   to be prepared.

1   28. The apparatus of claim 22, wherein detecting a

2   predetermined number of zero crossings to determine

3   whether a zero crossing flag should be set includes

4   determining whether a root mean square crossing value is

5 greater than a threshold value.

1   29. The apparatus of claim 22, wherein detecting

2 whether noise is present to determine whether a noise

3 flag should be set includes determining whether energy in

4 a current frame multiplied by a threshold is greater than

5 delayed frame energy.

1   30. The apparatus of claim 22, wherein detecting

2 whether a threshold amount of energy is present to

3 determine whether an energy flag should be set includes

4 determining if a logarithm of an autocorrelation of a

5 frame is greater than an energy threshold.

1   31. The apparatus of claim 22, wherein detecting

2 whether instantaneous energy is present to determine

3 whether an instantaneous energy flag should be set

4 includes determining whether a difference between a

5 current frames energy at an autocorrelation of a tenth

6 delayed sample and a prior frames energy at an

7 autocorrelation of a tenth delayed sample is greater than

8 a previous frames autocorrelation multiplied by a

9   threshold.

1   32. A method comprising:

2   determining whether a noise flag, a zero

3   crossing flag, an energy flag, and an

4   instantaneous energy flag should be set; and

5   utilizing a combination of the noise, zero

6   crossing, energy, and instantaneous energy

7   flags to determine whether voice is present.

1   33. The method of claim 32, further comprising:

2   detecting whether noise is present to

3   determine whether the noise flag should be set;

4   detecting a predetermined number of zero

5   crossings to determine whether the zero

6   crossing flag should be set;

7   detecting whether a threshold amount of

8   energy is present to determine whether the

9   energy flag should be set; and

10   detecting whether instantaneous energy is

11   present to determine whether the instantaneous

12   energy flag should be set.

1   34. The method of claim 33, further comprising,

2   performing fast Fourier transformation (FFT) processing

3   to determine whether a FFT flag should be set.·

1   35. The method of claim 32, further comprising,

2   performing an interim voice activity decision, a interim

3   voice activity decision flag being set to indicate that

4   voice has been detected by determining if the

5   instantaneous energy flag is set or the energy flag is

6   set and the noise flag is not set and the zero crossing

7   flag is not set.

1   36. The method of claim 35, further comprising,

2   performing HangOver and Speech Kick in processing after

3   the interim voice activity decision has been made to

4   determine whether a voice activity flag should be set or

5   cleared.

1   37. The method of claim 36, further comprising, if

2   the voice activity flag is set, sending a speech payload

3   to be packetized and updating the voice activity

4   detection flag for external interaction with other

5   functions.

1   38. The method of claim 36, further comprising, if

2   the voice activity flag is not set, disabling an

3   automatic level control and causing a silence insertion

4   description payload to be prepared.

1   39. The method of claim 33, wherein detecting a

2   predetermined number of zero crossings to determine

3   whether a zero crossing flag should be set includes

4   determining whether a root mean square crossing value is

5   greater than a threshold value.

1   40. The method of claim 33, wherein detecting

2   whether noise is present to determine whether a noise

3   flag should be set includes determining whether energy in

4   a current frame multiplied by a threshold is greater than

5   delayed frame energy.

1   41. The method of claim 33, wherein detecting

2   whether a threshold amount of energy is present to

3   determine whether an energy flag should be set includes

4   determining if a logarithm of an autocorrelation of a

5   frame is greater than an energy threshold.

1   42. The method of claim 33, wherein detecting

2   whether instantaneous energy is present to determine

3   whether an instantaneous energy flag should be set

4   includes determining whether a difference between a

5   current frames energy at an autocorrelation of a tenth

6   delayed sample and a prior frames energy at an

7   autocorrelation of a tenth delayed sample is greater than

8   a previous frames autocorrelation multiplied by a

9   threshold.

1   43. A machine-readable medium having stored thereon

2   instructions, which when executed by a machine, causes

3   the machine to perform operations comprising:

4   determining whether a noise flag, a zero

5   crossing flag, an energy flag, and an

6   instantaneous energy flag should be set; and

7   utilizing a combination of the noise, zero

8   crossing, energy, and instantaneous energy

9   flags to determine whether voice is present.

1   44. The machine-readable medium of claim 43, further

2 comprising:

3   detecting whether noise is present to

4   determine whether the noise flag should be set;

5   detecting a predetermined number of zero

6   crossings to determine whether the zero

7   crossing flag should be set;

8   detecting whether a threshold amount of

9   energy is present to determine whether the

10   energy flag should be set; and

11   detecting whether instantaneous energy is

12   present to determine whether the instantaneous

13   energy flag should be set.

1   45. The machine-readable medium of claim 43, further

2 comprising, performing fast Fourier transformation (FFT)

3 processing to determine whether a FFT flag should be set.

1   46. The machine-readable medium of claim 43, further

2 comprising, performing an interim voice activity

3 decision, a interim voice activity decision flag being

4 set to indicate that voice has been detected by

5 determining if the instantaneous energy flag is set or

6 the energy flag is set and the noise flag is not set and

7 the zero crossing flag is not set.

1   47. The machine-readable medium of claim 46, further

2 comprising, performing HangOver and Speech Kick in

3 processing after the interim voice activity decision has

4 been made to determine whether a voice activity flag

5 should be set or cleared.

1   48. The machine-readable medium of claim 47, further

2 comprising, if the voice activity flag is set, sending a

3 speech payload to be packetized and updating the voice

4 activity detection flag for external interaction with

5 other functions.

1   49. The machine-readable medium of claim 47, further

2 comprising, if the voice activity flag is not set,

3 disabling an automatic level control and causing a

4 silence insertion description payload to be prepared.

1   50. The machine-readable medium of claim 44, wherein

2   detecting a predetermined number of zero crossings to

3   determine whether a zero crossing flag should be set

4   includes determining whether a root mean square crossing

5   value is greater than a threshold value.

1   51. The machine-readable medium of claim 44, wherein

2   detecting whether noise is present to determine whether a

3   noise flag should be set includes determining whether

4   energy in a current frame multiplied by a threshold is

5   greater than delayed frame energy.

1   52. The machine-readable medium of claim 44, wherein

2   detecting whether a threshold amount of energy is present

3   to determine whether an energy flag should be set

4   includes determining if a logarithm of an autocorrelation

5   of a frame is greater than an energy threshold.

1   53. The machine-readable medium of claim 44, wherein

2   detecting whether instantaneous energy is present to

3   determine whether an instantaneous energy flag should be

4   set includes determining whether a difference between a

5   current frames energy at an autocorrelation of a tenth

6   delayed sample and a prior frames energy at an

7   autocorrelation of a tenth delayed sample is greater than

8   a previous frames autocorrelation multiplied by a

9   threshold.